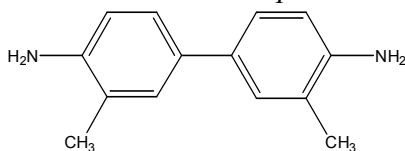


3,3'-DIMETHYLBENZIDINE

CAS No. 119-93-7

First Listed in the *Third Annual Report on Carcinogens*



CARCINOGENICITY

3,3'-Dimethylbenzidine is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC V.1, 1972). When administered by subcutaneous injection, commercial 3,3'-dimethylbenzidine induced Zymbal gland carcinomas and external auditory canal carcinomas in rats.

There are no adequate data available to evaluate the carcinogenicity of 3,3'-dimethylbenzidine in humans (IARC V.1, 1972; IARC S.7, 1987).

PROPERTIES

3,3'-Dimethylbenzidine is a white to reddish crystalline powder that is slightly soluble in water and very soluble in ethanol, ethyl ether, and dilute acids. It is produced as technical-grade dry and paste formulations of various purities. When heated to decomposition, it emits toxic fumes of nitrogen oxides (NO_x).

USE

More than 75% of the 3,3'-dimethylbenzidine consumed is used as a dye or an intermediate in the production of dyestuffs and pigments. According to the Society of Dyers and Colourists, more than 95 dyes are derived from 3,3'-dimethylbenzidine. About 20% of the 3,3'-dimethylbenzidine consumed is used to produce polyurethane-based high-strength elastomers, coatings, and rigid plastics. 3,3'-Dimethylbenzidine is used in small quantities by water companies and swimming pool owners in chlorine test kits, by clinical laboratories in test tapes for the detection of blood, or for the colorimetric determination of chlorine in air or water (IARC V.1, 1972).

PRODUCTION

Chemyclopedia 98 and the 1998 *Chemical Buyers Directory* both listed two U.S. suppliers of 3,3'-dimethylbenzidine (Rodnan, 1997; Tilton, 1997). The 1997 Directory of Chemical Producers identified one producer of the compound, with no reported volume (SR1a, 1997). 3,3'-Dimethylbenzidine was imported through the principal U.S. customs districts in 1989, however, the quantity was unpublished. In 1986 and 1985, there were three domestic producers of 3,3'-dimethylbenzidine, but no production volumes were reported (USITC, 1987; SR1a, 1986). No producers or production volumes were reported by the USITC in 1984 (USITC, 1985). One producer of 3,3'-dimethylbenzidine hydrochloride was identified in 1983

(USITC, 1984). Imports appear to be the major source of 3,3'-dimethylbenzidine in the United States. The USITC reported imports of 75,000 lb of 3,3'-dimethylbenzidine, and 163,700 lb of its hydrochloride in 1983, compared with the import of more than 5,000 lb of 3,3'-dimethylbenzidine hydrochloride in 1980. Approximately 3.5 million lb of 3,3'-dimethylbenzidine and 240,000 lb of the hydrochloride were imported into the United States in 1979 (USITC, 1984). The 1979 TSCA Inventory identified one producer of 3,3'-dimethylbenzidine with production volume not specified and four companies importing 115,500 lb in 1977. The CBI Aggregate was between 1 million and 100 million lb (TSCA, 1979). The major company producing 3,3'-dimethylbenzidine in the United States ceased production in 1978; its average annual production was about 200,000 lb.

EXPOSURE

The primary routes of potential human exposure to 3,3'-dimethylbenzidine are inhalation, dermal contact, and ingestion. ACGIH has recommended no threshold-limit value (TLV) time-weighted average (TWA) for 3,3'-dimethylbenzidine because it is regarded as a suspected human carcinogen (ACGIH, 1986). Workers potentially exposed to 3,3'-dimethylbenzidine include dye makers, repackagers of 3,3'-dimethylbenzidine and dimethylbenzidine-based dyes, and personnel in clinical and analytical laboratories. Workers in a variety of occupations may possibly be exposed to small quantities of 3,3'-dimethylbenzidine used for analytical purposes, including water and sewage plant attendants, chemical test tape or kit makers, and swimming pool service representatives. Swimming pool water test kits contain 0.5%-1.0% 3,3'-dimethylbenzidine. Exposure may occur if the test solutions are emptied back into the pool. In 1978, NIOSH estimated that fewer than 100 employees possibly were exposed to large quantities of 3,3'-dimethylbenzidine in the United States, but as many as 200,000 may possibly be exposed to small quantities (NIOSH, 1979e). The National Occupational Exposure Survey (1981-1983) indicated that 8,676 workers, including 5,383 women, were potentially exposed to 3,3'-dimethylbenzidine (NIOSH, 1984). This estimate was derived from observations of the actual use of the compound (62% of total observations) and the use of tradename products known to contain the compound (38%). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 420 workers were potentially exposed to 3,3'-dimethylbenzidine in the workplace (NIOSH, 1976).

Dimethylbenzidine-based dyes and pigments are metabolized to 3,3'-dimethylbenzidine. Residual levels of 3,3'-dimethylbenzidine may be present in dimethylbenzidine-based dyes and pigments and in the final consumer products. Available data indicate that such contaminants occur in the parts-per-million range. A dimethylbenzidine-based dye was not absorbed dermally to any substantial degree when tested in rabbits.

The Toxic Chemical Release Inventory (EPA) reported that one facility produced, processed, or otherwise used 3,3'-dimethylbenzidine in the United States in 1996. The facility, located in Gibraltar, Pennsylvania, reporting under the industrial classification for manufacture of cyclic crudes and intermediates (SIC Code 2865), released a total of 6 lb to air and 25 lb to water (TRI96, 1998).

REGULATIONS

EPA regulates 3,3'-dimethylbenzidine under the Resource Conservation and Recovery Act (RCRA) as a hazardous constituent of waste and has established a reportable quantity (RQ) of 10 lb under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Under the Superfund Amendments and Reauthorization Act (SARA), 3,3'-dimethylbenzidine was placed on a list of toxic chemicals subject to reporting requirements, and general threshold quantities have been established for facilities using or producing the compound. NIOSH recommended a 20 $\mu\text{g}/\text{m}^3$ ceiling for 3,3'-dimethylbenzidine exposure in the workplace, with no skin contact. OSHA has set standards limiting occupational exposure to 3,3'-dimethylbenzidine. OSHA regulates this compound under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-51.